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FLOOD RISK ASSESSMENT AND SURFACE WATER MANAGEMENT STRATEGY

FOR PROPOSED DEVELOPMENT

at

BARNSLEY ROAD, WOMBWELL

Prepared for

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FLOOD RISK ASSESSMENT AND

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1 INTRODUCTION

1.1 iD Civils Ltd (iD), have been appointed by Persimmon Homes West Yorkshire (PHWY) to prepare a Flood Risk Assessment (FRA) and surface water drainage management strategy report for the proposed residential development at Barnsley Road, Wombwell.

1.2 The report will be undertaken in accordance with Environment Agency (EA), Barnsley Metropolitan Borough Council (BMBC) and Yorkshire Water (YW) development control policy, and will focus on:

Site Use and Current Drainage regime, Flooding History, Ground Conditions and use of SUDS, Impact of development and proposed drainage strategy, flash flooding routes and the overall impact of development on the site and surrounds.

1.3 The report is for the sole use of PHWY and presents comments and conclusions based on information available at the time of writing. iD Civils reserve the right to amend conclusions if further information is made available.

2 BACKGROUND

2.1 PHWY is seeking detailed planning permission to develop a greenfield site on the north eastern side of Wombwell. The site is to the north of Barnsley Road and south of Mitchells Way. The development site is 6.74 Ha in area (gross). A location plan for the site is included in Appendix A.

2.2 This Flood Risk Assessment has been undertaken with reference to the following reports, documents and plans:

- Environment Agency Flood Zone maps (EA website and SFRA)
- Barnsley Metropolitan Borough Council Strategic Flood Risk Assessment (JBA, 2010)
- Barnsley Metropolitan Borough Council Preliminary Flood Risk Assessment.
- Phase 1 (desk top) Site Investigation (Lithos Environmental)
- Topographical Survey
- Sewer Record Plans (Yorkshire Water)
- National Planning Policy Framework (NPPF)
- CIRIA C697 – SUDS Manual
- CIRIA C624 Development and Flood Risk

- Defra – National Standards for Sustainable Drainage Systems
- Yorkshire Water Development Control Standards

In addition, iD Civils has undertaken a walkover survey of the site. Commercially available aerial photographs and historic ordnance survey maps of the area have also been used during the preparation of the report.

2.3 **Site Walkover:** A site visit was undertaken in May 2013. During the site walkover overland flood routes onto and from the site were inspected in order to assess the risk of flooding from external sources.

3 REGULATORY GUIDANCE

3.1 National Planning Policy Framework (NPPF), along with the technical guidance to NPPF and the withdrawn PPS25 provides the regulatory framework and guidance for planning authorities in relation to Flood Issues for new developments. Any application submitted to a local planning authority will be considered in conjunction with this guidance, and dependant on the nature and location of the application, the planning authority may request a site specific Flood Risk Assessment as part of the planning application documents.

3.2 The Environment Agency is a statutory consultee to the local Planning Authority in relation to flood risk issues. The EA have responsibility for the management of Main Rivers.

3.3 BMBC is the Lead Local Flood Authority (LLFA) with respect to Wombwell, and has responsibility for control and management (but not maintenance) of ordinary watercourses. The Land Drainage Act 1991 provides a regulatory framework for this issue.

3.4 The watercourses in the area are administered by the Dearne and Dove Internal Drainage Board which are part of the Shire Group of drainage boards. The board utilises Jeremy Benn Associates to deliver their obligations.

3.5 BMBC appointed Jeremy Benn Associates (JBA) to prepare a Level 1 Strategic flood Risk Assessment (SFRA) which was published in 2010.

3.6 Under the Flood Risk Regulations 2009 the LLFA has a duty to prepare a Preliminary Flood Risk Assessment (PFRA). The PFRA is a high level risk assessment based on existing information where available. The process led to the publication of the BMBC PFRA in June 2011 which highlighted local areas at risk of flooding.

3.7 The EA has produced a matrix for local planning authorities, which provides advice in terms of the requirements for risk assessment. 'Environment Agency Standing Advice – Development and Flood Risk' dated February 2009 tabulates the requirements relative to the scale of the development and the applicable Flood Zone. The assessment is required for all sites larger than 1 Ha in flood Zone 1 and all sites regardless of size in Flood Zones 2 and 3.

3.8 The Environment Agency have undertaken a national study of flood risk across England and published flood maps covering the country. The maps can be viewed on the agency web site at **www.environment-agency.gov.uk**. Specific locations can be studied by searching either using postcode or address.

3.9 The EA flood maps identify 3 zones.

Flood Zone 1: This zone comprises land with a less than 1 in 1000 annual probability of river or sea flooding in any one year (<0.1%)

Flood Zone 2: This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-0.1%) in any year.

Flood zone 3: The zone comprises land assessed as having a 1 in 100 year or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Flood risk should be assessed from the following sources; tidal and river, surface water and flooding from land, groundwater, sewers and artificial sources e.g. canals and reservoirs.

Flood zone plans reflect the undefended flood scenario for a particular area. Many flood areas are defended with flood defences of varying types and design life. Areas benefiting from flood protection are shown hatched on the EA plans.

3.10 The level of detail and complexity of a Flood Risk Assessment can vary considerably, dependant on the scale, nature and location of the planned development. EA guidance sets out the criteria for the level of information which should be included within the FRA.

3.11 The application site is within EA **Flood Zone 1** in accordance with the published EA flood zone plans. An extract of the flood risk plan is presented in appendix B.

3.12 The Technical Guidance to NPPF refers to vulnerability classifications, which are based on the sensitivity of different forms of development. In accordance with the technical guidance to NPPF, the intended end use planned for this development is classed as 'More Vulnerable' (residential). The site is therefore **appropriate** within flood zone 1.

3.13 **The Sequential Test:** In accordance with NPPF, LPA's allocating land for development should apply the Sequential test, to demonstrate that there are no available sites in the area with a lower risk of flooding. The site is within Flood Zone 1 therefore there are no sites of a lower risk in the area.

3.14 **The Exception Test:** The exception test is relevant if, following the application of the sequential test; it is not possible for the development to be allocated in zones of lower probability of flooding. The exception test criteria are detailed in The Technical practice guide of PPS25. The test provides a method of managing flood risk while still allowing necessary development to occur.

The sequential and exception test are not relevant in this particular instance.

3.15 BMBC Local Development Framework, Core Strategy Publication (Policy CSP4 – Flood Risk) states that the extent and impact of flooding will be reduced by:

- Not permitting new development where it would be at an unacceptable risk of flooding or would give rise to flooding elsewhere.
- Requiring site specific flood risk assessment for development proposals over 1 Ha in Flood zone 1.
- Requiring all development proposals on Brownfield sites to reduce surface water run-off by 30% and development on Greenfield Sites to maintain existing run-off rates.
- Requiring development sites to use Sustainable Drainage Systems in accordance with policy CSP3

3.16 Yorkshire Water work within the framework of 'Sewers for Adoption', which sets the standard for adoptable surface water and foul waters sewers. They also apply development control standards which are consistent with current best practice and Building Regulations.

3.17 Developers are encouraged to make 'pre development' enquiries to YW to ensure that there is sufficient time for the company to fully assess the capacity of their network and treatment works. This process also ensures that drainage strategies are acceptable in principle, prior to planning permission and helps avoid any objections from YW during the planning process. iD submitted a pre development enquiry in May 2013. A copy of YW's response is enclosed in appendix F.

3.18 The emerging 'Flood and Water Management Act 2010' will fundamentally change the way developers and local authorities approach the design and adoption of SuDS drainage. New SuDS Approving Bodies (SAB) will be formed to ensure adequate consideration is given to SuDS methods of drainage and the SAB will act to approve SuDS designs and adopt the constructed drainage. As LLFA BMBC is expected to be appointed as the SuDS Approval Body for this area.

3.19 A new set of SuDS standards is currently out to consultation amongst stakeholders, and will be implemented later in the year. The 7th edition of 'Sewers for Adoption' has been published, but will not be enforced by YW until the SuDS standards are adopted and the Flood and Water Management Act comes into force. The timetable for the Act coming into force is unclear. Best estimates are towards the end of 2013/early 2014.

3.20 The principles identified in the consultation SuDS standards have been considered in developing the strategy outlined in this report, on the assumption that the strategy will be consistent with best practice and that ultimately the site will come forward after the SAB's are in place.

4 SITE DESCRIPTION AND HISTORY

4.1 A site location plan is included within Appendix A of this report. Site details are summarised in the Table below.

Table 3882.1 - Site Location Summary

Detail	Remarks
Location	Approx 5KM SE of Barnsley Centre.
NGR	SE 395 035
Area	6.75 Ha (gross)
Current Use	Arable Farmland

4.2 **Topography:** The topographical survey and walkover survey indicate that the site is steeply sloping towards the north eastern boundary with the woodland adjacent to Mitchells Way (A633). The highest point of the site is adjacent to Barnsley Road with an elevation of cc 54m AOD. The lowest point is central along the north eastern boundary with a level of 34.4m AOD. The site falls at typical gradients of approximately 1:8 to 1:15.

4.3 Barnsley Road forms part of the south eastern boundary and is separated from the site a retaining wall which varies in height from 1m – 2m. The retaining wall is at the rear of the footpath along Barnsley Road.

4.4 The north eastern boundary is predominantly formed by a fence line adjacent to a small copse of trees with Mitchells Way to the north. The offsite copse has an embankment along its edge just outside the site boundary with an approximate height of 1.0m to 1.4m above the lowest edge of the site. The bund is discussed later in this report, and is assumed to have been constructed as part of the works associated with Mitchells Way.

4.5 Boundaries to the site are a mixture of stone walls, fences and hedges as shown on the topographical survey. The site comprises a single large field

4.6 **Adjacent Land use:** The site is bounded by the following features:

Table 3882.2 -Adjacent Land Uses

North	Small woodland copse and Mitchells Way (A633) beyond.
South	Mixture of commercial and residential property along with frontage to Barnsley Road
East	Commercial property and pedestrian footbridge and raised embankment
West	Residential property

4.7 **Previous Development:** iD Civils have reviewed the Phase 1 desk top study undertaken by Lithos Environmental. The report indicates that there has been no previous 'development' use on the site.

4.8 **Existing Hard standing:** The site does not contain any areas of hard standing or drained roofs.

4.9 **Hydrology:** There are no open watercourses crossing the site, or adjacent to the site boundaries. The nearest watercourse is an unnamed tributary of Bulling Dike which runs approximately 200m north of the site on the southern side of the dismantled railway. The tributary watercourse appears to be culverted below the former railway and Bulling dike emerges to the north of the culvert.

4.10 Bulling Dike flows eastwards to discharge into the River Dearne approximately 1.5KM to the east of the site.

4.11 The Lithos report confirms that the site is not within a source protection zone and there are no water abstractions within the vicinity. There have been no pollution incidents relevant to this site.

4.12 Plans contained on the EA web site do not indicate there is a problem with groundwater in this area.

5 EXISTING SITE DRAINAGE

5.1 iD has obtained a copy of the Yorkshire Water Sewerage Record plans for the area. A summary is presented below and the plans are enclosed within appendix D:

Table 3882.4 – Existing Sewers Summary

Sewer Type	Comment
Surface Water	There are no surface water sewers crossing the site. The nearest surface water sewer is within Barnsley Road to the southern boundary and Littlefield Lane to the east.
Foul Water	There are no foul sewers crossing. The nearest foul sewer is within Barnsley Road to the south of the site.
Combined Sewers	There are no combined sewers crossing the site. The nearest combined sewer is within Rimmington Road (450 dia) and Littlefield Lane (600 dia). There are also combined sewers within Barnsley Road (300 dia).
Highway Drains	iD Civils has no records of highway drainage in the area.

5.2 There may be land drainage within the proposed site. Care should be taken to avoid damage to land drainage systems during site earthworks. Land drainage systems should be maintained or diverted around proposed new development wherever possible to avoid changing the natural drainage patterns.

5.3 The site is within the Bulling Dike catchment area.

6 PROPOSED DEVELOPMENT

6.1 PHWY is promoting a detailed application for residential dwellings. The site will be accessed from Barnsley Road along the south western boundary by a new adoptable specification estate road.

6.2 New dwellings provide a range of accommodation and styles from small terraced units to large family homes with private front and rear gardens.

6.3 Due to the retaining wall which separates the site from Barnsley Road it is anticipated that the initial section of highway access will be elevated above the ground levels within the site by cc 1.5m. The majority of the site is likely to be +/- 0.75m from current ground levels.

6.4 The net developable area of the site (excluding open space and landscape buffers) is estimated as 5.61 Ha.

6.5 It is estimated (from experience of similar types of development) that the overall site may produce an impermeable fraction of around 55% of the gross site area. The total anticipated impermeable area of the proposed development is estimated as 3.08 Ha (roofs, driveways and highways). Flows from the likely catchment could be in the order of 428 l/s in the 1 in 1 year event, and 640 l/s in the 1 in 30 year event.

6.6 Highways within the site will be offered for adoption with Barnsley Metropolitan Borough Council, via a section 38 agreement. Main sewers within the site will be offered for adoption to Yorkshire Water via a section 104 agreement. Adopting authorities will maintain the roads and sewers in perpetuity.

7 FLOOD HISTORY AND SITE VULNERABILITY

7.1 Flooding can occur from a variety of sources, including tidal, rivers, watercourses, overland run-off, groundwater, sewers and culverts. NPPF and BMBC guidance requires flood risk from all sources to be evaluated and suitable mitigation provided.

7.2 Inspection of the EA flood map indicates that the site falls within Flood Zone 1 and has a low risk of flooding from fluvial and tidal sources. A copy of the Flood Zone Plans included within Appendix B.

7.3 **Preliminary Flood Risk Assessment:** BMBC has published the PFRA in 2011. The PFRA was based on a review of historical flood information from a range of sources. Within the PRFA there are a number of plans which present details of significant areas of flood risk. Within appendix 2 there is a plan of previous recorded flood events in Wombwell.

7.4 The plan, which is presented in appendix C indicates areas of the site along the low north eastern boundary which are ‘susceptible to surface water flooding’. This area is considered to be an area of flooding which originates from overland flows generated from within the site. The flows which would be directed to the lowest point on the site would effectively be trapped behind the embankment on the edge of the woodland. It is considered likely that this feature was constructed as a ‘flood mitigation bund’ to protect Mitchells Way. The extents are based on the crest height of the bund and reflect the area of the site which may be susceptible prior to overtopping of the flood bund.

7.5 Areas to the north of the site beyond Mitchells Way are indicated as susceptible to fluvial flooding on both the plans contained within the PFRA and also the Flood Zone plans published by the EA.

7.6 A request for detailed historical flood records has been issued to BMBC. BMBC confirm that

'I am not aware of any flooding issues associated with the area of the site to the south of Barnsley Road'.

7.7 A request for historical flooding information was also made to the Dearne and Dove Internal Drainage Board. At the time of writing this report details are awaited.

7.8 **Flood Vulnerability and Climate Change:** NPPF provides guidance with respect to the implications of climate change and suggests appropriate additional allowances for climate change with respect to rainfall intensities. It also recommends the following precautionary sensitivity ranges are applied to rainfall intensities for the design life of the development:

Table 3882.5 – Climate Change Allowances

Parameter	1990-2025	2025-2055	2055-2085	2085-2115
Peak Rainfall Intensity	+5%	+10%	+20%	+30%
Peak river Flow	+10%	+20%		

7.9 The Practice guide to PPS25 states that for residential development a 100 year design life should be assumed. Therefore in accordance with the above table a climate change factor of 30% should be built in to all designs where applicable to protect against future increases in rainfall.

8 FLOOD IMPACT AND MITIGATION MEASURES

8.1 NPPF guidance requires the risk from a range of potential sources to be evaluated, as follows:

8.2 **Overland Flooding:** Based on the site walkover survey, review of the topographical survey, the risk of flooding onto the site from adjacent land is low due to the relative levels between the site and its surroundings. The highest point of the site boundary is adjacent to Barnsley Road which would effectively form a barrier to water entering the site. Land to the north, east and west is lower than the site or has been previously developed with a positive drainage system.

8.3 The risk of overland flows from the site towards adjacent land is considered low given the existing bund along the low boundary.

8.4 The most significant risk of overland flooding is from flows generated within the site flowing to the low point of the site. At present when ground becomes saturated, or during periods of intense rainfall when the ground is hard, water will flow down the site across the surface and collect within the low area along the north eastern boundary. Whilst development will increase the amount of hard standing area within the site, there will be a positive drainage system designed to accommodate flows from the 1 in 100 year event with attenuation storage commensurate to the design storm. It is considered that development will therefore have a beneficial effect on flooding within the site be the creation of a purpose designed system which will control flows to the storage facility.

8.5 Plots within the low lying area of the site should be lifted so that the floor level is 300mm above the crest of the adjacent bund. This will offer protection in the event that the surface water system becomes blocked, or flows inundate the site from higher ground due to pluvial flooding of the network.

8.6 **Flooding from Rivers / Watercourses or the Sea:** The risk of flooding from the sea is low by virtue of the inland location of the site. Flood risk from fluvial sources (River or watercourses) is low due to the distance between the site and the watercourses to the north, the relative levels from the site to the watercourse.

There is a watercourse to the east of the site beyond Littlefield Lane which is at a higher level than the site. This watercourse receives flows from a YW surface water sewer. Any flooding from this watercourse would flow north onto Mitchells Way within the low spot approximately 100m from the eastern edge of the site.

8.7 **Flooding from Culverts or field drains:** iD Civils are not aware of any existing culverts or land drains within the site.

8.8 **Flooding from Sewers:** There are no surface water sewers within the site. The nearest surface water sewer is within Barnsley Road and any flows from the sewer will be contained within the road corridor.

There is a 300-450mm diameter combined sewer within Rimmington Road which if blocked may pose a risk of flooding to the site. There are properties between the site and the sewer which would be affected first and it is considered that any flooding from this sewer would be reported and rectified before it had a major impact on the site.

8.9 **Flooding from artificial sources:** The YW mains records do not indicate any substantial water mains within the site or adjacent to the site. The nearest water main which could pose a risk to the site is within Barnsley Road. This main is 100mm diameter and laid within the carriageway. Flows from any leak in the main would flow into the gulley system or pass along the channel of the road flowing north.

EA flood maps published on the web site do not show the area as at risk from reservoir breach.

8.10 **Groundwater Flooding:** The PFRA and SFRA do not highlight Wombwell as an area at risk from groundwater flooding. BMBC has confirmed they are not aware of any groundwater flooding issues.

8.11 **Downstream Sensitivity:** The site and immediate area downstream is not indicated as susceptible to flooding. The site is part of the Bulling Dike catchment which is sensitive to flooding. There are flood warning areas noted on the EA maps approximately 300m north east of the site within proximity of Bulling Dike. It is important that the surface water management strategy reflects the sensitivity of the downstream receptor and mitigates against increases in run-off from the site as required in development control standards and BMBC policies.

8.12 **Development Levels:** Dwelling floor levels should be carefully considered in any low lying areas of the site, or areas which are potentially at risk from overland flows generated within the site. Dwellings at risk should be designed 300mm above the natural ground level, or be designed to produce an overland flood route around the dwelling to mitigate against the risk of internal flooding.

9 SUDS

9.1 Building Regulations (Part H), NPPF, YW and BMBC development control policies and Environment Agency advice notes, require the consideration of sustainable drainage techniques for new developments. This existing legislation is to be reinforced by the emerging Flood Water Management Act which will provide a formal structure for the adoption of SuDS drainage and further encourage their use.

9.2 Surface Water drainage should be considered in accordance with a prescribed hierarchy aimed at minimising the impact of development. Surface Water flows should be designed to discharge to:

1. Infiltration based or sustainable drainage systems
2. Watercourses
3. Surface water Sewers
4. Combined water sewers

Designers should evaluate drainage options in accordance with this hierarchy. Developer's rights to connect surface water into the drainage system under section 106 of the Water act will be withdrawn as part of the new act until it can be proven to the SAB that methods of drainage further up the hierarchy cannot be reasonably achieved.

9.3 Guidance on SUDS techniques can be found in the SUDS Manual (Ciria 2007). There are various forms of technique available as summarised below:

Table 3882.6 – Forms of SuDS Drainage

Technique	Description
Trenches	Shallow excavations filled with rubble or stone that create temporary storage and either filter into the ground or convey water to an outlet. Known as 'French drains'
Swales	Shallow linear vegetated drain ditches which can either convey flows to an outlet or infiltrate via a granular sub base to the sub strata.
Pervious Pavements	Material which allows water to permeate into underlying sub strata – best utilised on flat sites with permeable sub strata. Permeable paving can be used on clay sub strata but will require a piped drainage outlet from the sub base to a positive system.
Geocellular Systems/Tank systems	Modular plastic geocellular systems which have a high void ratio and allow water to be storage below ground. Large diameter pipework or purpose designed tanks to allow below ground storage.
Infiltration Basins	Vegetated depressions which allow water storage and slow infiltration into the ground
Detention Basins	Surface water storage basins which remain dry when not in use and allow flood water to collect and discharge to a design flow rate

Ponds	Ponds can provide both attenuation and treatment features, together with landscape and ecology value. Run off through storms is attenuated in an upper level above ambient pond depths. Many councils have published design standards if a developer intends to offer ponds for adoption. Design standards within WMDC area are covered later in this report.

9.4 The use of SUDS techniques is designed to mitigate the impact of development on receiving watercourses or sewers by mimicking pre development conditions as far as possible. New development should not worsen flooding downstream and should attempt to improve flooding wherever practical.

9.5 Sustainable Drainage can take many forms dependant on site use, layout, ground conditions and topography. In terms of the hierarchy of sustainable options, infiltration based systems should be considered in the first instance i.e. soakaways/infiltration swales/basins etc. The use of infiltration systems will be subject to the infiltration characteristics of the natural ground below the site. In areas with cohesive sub soils it is unlikely that sufficient percolation can be provided to allow the implementation of infiltration techniques.

9.6 A detailed site investigation report should be undertaken to accurately determine the nature of strata below the site and the infiltration properties. The Lithos Environmental desk top study confirms that the site is likely to be underlain by shallow bedrock or thin weathered bedrock deposits. Soakaways may be a viable option for the site dependant on the degree of weathering of the shallow rock. If infiltration rates allow the use of soakaways, this option would be the preferred solution for surface water drainage. Drainage options covering the use of soakaways and also in the event that they cannot be used are covered in the drainage strategy section of this report.

9.7 Sustainable Drainage in areas of cohesive sub soils can be provided by a range of flow attenuation devices to suit the proposed development, policies of adopting authorities and planning authority requirements. Attenuation ponds and swales can provide ecological benefits by the creation of wetland habitats. Ponds can be designed to contain a permanent body of water with a freeboard capacity to attenuate peak storm events up to the 1 in 100 year plus climate change event. The detailed design and location of ponds with a permanent body of water will need to be agreed with the planning authority.

9.8 Due to the sloping topography of the site, the provision of a formal pond/basing feature to attenuate surface water flows may prove difficult due to the shallow batter slope requirements which would require significant earthworks.

9.9 Provision of attenuation storage volume by underground tanks or oversize sewers is also an acceptable form of SUDS drainage and in many cases may provide the most practical solution to meet the requirements of guidance due to the availability of land or other constraints, particularly in small infill sites of this nature. In order to achieve adoption requirements the 1 in 30 year flows should be stored within tanks however flows between 1 in 30 years and 1 in 100 year can be stored above ground provided that there is no risk to property or downstream flooding. This would be an option on this site.

10 PROPOSED DRAINAGE STRATEGY

10.1 The development of the site will require a new drainage system designed to suit the final approved layout, and in compliance with current Building Regulations and Sewers for Adoption. The system will be adopted by YW under a section 104 agreement.

10.2 A drainage strategy can be determined based on the available information and regulator liaison to date. This strategy is illustrated on the plan within appendix G. A summary is provided below:

10.3 **Foul Drainage:** iD Civils has undertaken a 'pre-development enquiry' with YW. The response to our enquiry is contained within appendix D.

Yorkshire Water confirms that:

'Foul water domestic flows should discharge to the 450mm diameter public combined sewer recorded in Rimmington Road, at a point adjacent the site.

From the information supplied it is not possible to determine if the whole site will drain by gravity to the public sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a sewage pumping station will be required to facilitate connection to the public sewer network. If sewage pumping is required foul water discharge must not exceed 12 litres/second.'

Discussion: The foul sewer in Rimmington Road is at a higher level than a significant part of the site. Any connection to this sewer would require a pumped outfall. In addition the site is not adjacent to Rimmington Lane and any connection would require third party land. A connection could be requisitioned via Yorkshire Waters powers under section 98 of the Water Act; however there are alternative means of connection that would not require this process (subject to YW approvals).

The foul flows from the site will require pumping to the adjacent system. A connection into the 300mm diameter sewer in Barnsley Road would not require third party land and may be acceptable to Yorkshire Water.

10.4 **Surface Water and SuDS Hierarchy:** In accordance with the hierarchy contained within Part H of the building regulations, NPPF and the emerging SuDS standards, the surface water strategy should be considered in order of the sustainable hierarchy. The hierarchy and ability of the site to support the particular elements of the hierarchy are discussed below:

10.5 **Discharge to infiltration drainage/soakaway:** The ability of any development to discharge to infiltration drainage is wholly reliant on the ground conditions across the site. The desk top study site investigation indicates that drainage via infiltration methods may be possible on the site, subject to intrusive investigation and infiltration testing.

Subject to adequate infiltration rates and agreement with the drainage and local authority drainage via soakaways is the **preferred option** for the site.

10.6 **Discharge to Watercourse:** Subject to the preferred options (above) not being possible, the site can be drained to a watercourse. The nearest watercourse is approximately 200m to the south of the site. Based on the walkover survey of the offsite route the surface water from the site can be discharged by gravity to a tributary of Bulling Dyke on the southern side of the dismantled railway. The watercourse is within third party land ownership and either agreement with the landowners or a sewer requisition would be required to make the connection. The site is within the catchment of Bulling Dike and the maintenance of a Greenfield run off rate for the new development will not exacerbate flooding downstream.

10.7 **Discharge to Surface Water Sewer:** There are no suitable surface water sewers which could be utilised to discharge the site into.

During the site walkover highway drainage on the southern side of Mitchells Way was noted. It may be possible to utilise highway drainage to provide the surface water outfall subject to establishing the route, level, capacity and ultimate outfall of the system. It is assumed that the system will ultimately discharge to Bulling Dike. For proposals to ustilise the highway drainage network to be advanced further discussions would need to be held with the highway authority and Yorkshire Water.

10.9 **Discharge Rate:** If infiltration drainage can be used the discharge rate from the site post development compared to pre development will remain unchanged due to the numerous small catchments and multiple points of infiltration. If soakaways cannot be utilised in order to protect the downstream watercourse the discharge rate from the site should be set at the Greenfield rate in accordance with BMBC development control policy. The pre development Greenfield rate for the area in accordance with BMBC development control policy is 5 l/sec/Ha. Assuming only areas which are developed (5.6 Ha); the total equivalent Greenfield discharge rate for the site is 28 l/sec.

10.10 Maximum discharge rates should be maintained between the 1 in 1 year and 1 in 100 year events. An allowance of 30% should be made for climate change factors for the 1 in 100 year event as prescribed in the technical guide to NPPF.

10.11 **Storage:** New drainage should be designed to provide attenuation storage to flows in excess of the design discharge rate. Storage capacity should allow for flows within the network from the 1 in 30 year event without flooding. Flood water from the 1 in 100 year (plus climate change) event should be stored on site without increasing flood risk elsewhere, or if that is not possible due to site constraints, stored within the network.

10.12 Storage volume for the 1 in 30 year event is estimated at 1840m^3. Storage for the 1 in 100 year plus climate change event is estimated as 2525m^3.

10.13 If storage tanks are required they would be located below the open space along the north eastern boundary of the site. Given the existing bund in the woodland the open space would be capable of storing flood water in excess of the 1 in 30 year event (approx 700m^3). The adjacent plots would be elevated above the crest of the bund so there would be no risk to plots. Given the topography the estate road network would be higher than the crest of the bund so water could be stored in the low lying open space safely and not flow out of the site.

10.14 The use of filter strip and trench soakaways should be promoted if the site is suitable for infiltration drainage. Due to the sloping nature of the site the use of permeable paving may be problematical, however filter strip can be used on the low side of small hard standing areas as an alternative.

10.15 The plan in appendix F illustrates the likely position of underground storage for the 1 in 30 year event should infiltration drainage not be possible, along with an approximate extent of above ground storage for the 100 year event and adjacent ground and plot levels.

11 IMPACT OF DEVELOPMENT AND RESIDUAL RISK

11.1 A detailed Flood Risk Assessment and drainage management plan has been undertaken with respect to the planned development at Barnsley Road, Wombwell. The FRA has been undertaken in accordance with EA, YW and BMBC development control guidance, and considers the setting of the development and likely impact on surrounding areas. A drainage strategy has been outlined in the report.

11.2 The development site has been identified as within flood zone 1. Residential development is **appropriate** within Flood Zone 1.

11.3 Low lying parts of the development have been identified from the PFRA as susceptible to flooding and the cause of the flooding has been described in detail and illustrated on the plan within appendix *.

11.4 The assessment has identified the current site drainage characteristics in accordance with BMBC development control policy, and also established the current level of risk from flooding. A summary of the risks and mitigation identified is presented below:

Table 3882.7 - Summary of Main Issues

Issue	Summary	Risk
Flood zone	Flood Zone 1 Development proposed is compatible to the flood setting.	**Low**
Fluvial flooding	Low risk of flooding from Fluvial and Tidal sources	**Low**
Pluvial flooding	Low significant risk of pluvial flooding noted.	**Low**
Overland Flooding	Overland flooding from land within the site contributes to a risk of flooding within low lying areas of the site. The offsite flood bund retains water flowing from the site. Plots adjacent to and within the areas susceptible to flooding to be elevated above the crest of the bund to mitigate the risk of flooding. On site drainage system will also mitigate the risk of flooding by preventing sheet run-off to low parts of the site.	**Low**
Artificial Sources	No significant artificial sources known	**Low**
Flood Mitigation	Recommend lifting plots in low lying areas susceptible to flooding 300mm above the crest of the offsite embankment. Design of plot and road levels to prevent flood routes for low parts of the site endangering property.	**Low**
Surface Water Management	Infiltration drainage may be appropriate for the site subject to underlying ground conditions and percolation testing. Id infiltration is not considered possible the site should be attenuated to Greenfield flows in accordance with Barnsley MBC development control policy. All storage should be contained within the site	**Low**

	at a point which does not pose a flood risk to adjacent new properties.	

11.5 On the basis of the above report it is considered that the site can be designed to comply with relevant legislation, good practice and development control policy.